EOS
TRANSACTIONS, AMERICAN GEOPHYSICAL UNION
VOLUME 62 NUMBER 35 SEPTEMBER 1, 1981

The Oceanography Report—pages 650–653

EOS, TRANSACTIONS, AMERICAN GEOPHYSICAL UNION VOL. 62, NO. 35, PAGES 649-656 SEPTEMBER 1, 1981

Planetology

6570 Surface of moon (mechanical properties)
PRESSURE DEPENDENCE OF THE VELOCITY OF LUNAR SOIL: THE VELOCITY/DEPTH VARIATION IN THE SHALLOW LUNAR CRUST
A.F. Gangi (Department of Geophysics, Texas A&M University, College Station, Texas 77843)

Some recent measurements (Johnson, et al, 1980) of the velocity variation with pressure (up to 2.0 kbar) for lunar soil are compared with results from the Hertzian-contact theory. Their results are consistent with the Hertz theory when the effects of non-recoverable compaction are taken into consideration. A simple analysis is given which shows that the velocity of a loosely packed soil (which has only a fraction, f, of the grain contacts of a well packed soil) will be smaller than that of the well packed soil by the factor $f^{1/6}$ (0<f<1). A reanalysis of some earlier experimental data by Talwani, et al (1973) for the velocity variation with pressure (up to 2.5 kbar) of a volcanic ash also shows that the modified Hertzian-contact theory can be used to fit those data. It is found that the velocity function:

$$v(P) = 2.95\, P^{0.1??}$$

gives a better fit (rms errors ≤65 m/sec) to the experimental data than a best-fit equation of the form proposed by Talwani, et al:

$$v(P) = 1.1?? \,(1 + (P/0.7??))^{1/2} - P/1.45)$$

which has a rms error of ?? m/sec for the same data. The curves fitted to the data of Johnson, et al (1980) would give a velocity variation for the shallow lunar crust equal to

$$v(z) = 2?? \,(?z)^{1/6}\ m/sec$$

for z in meters [illegible] to [illegible] depths. This [illegible] quite well with the velocity variation for the [illegible] ten meters of the Moon as interpreted by [illegible], Lunar and [illegible] (1973),

$$v(z) = ??0\, z^{1/6},$$

using the data from the Apollo-14 and Apollo-16 Active Seismic Experiments [illegible] [illegible] the Moon, (Kovach, et al, 1971, 1972). [illegible]

[illegible]

J. Geophys. Res., Red, Paper 1B?9?

6510 Surface of moon
NEAR-INFRARED SPECTRAL REFLECTANCE, A FIRST GOOD LOOK
T.B. McCord (Hawaii Institute of Geophysics, University of Hawaii, Honolulu, Hawaii 96822) R.N. Clark, B.R. Hawke, L.A. McFadden, P.D. Owensby, C.M. Pieters, and J.B. Adams

A qualitive identification of the minerals olivine, plagioclase, and several types of pyroxenes were made at several locations on the lunar surface using remote measurements. For example, the crater Aristarchus is found to have an average pyroxene composition of augite, and plagioclase is obviously present. A dark mantle deposit in the crater J. Herschel is at least partly composed of a mixture of 10% olivine and 90% pyroxene. These determinations were possible because the reflectance spectra for 10-20 km diameter lunar areas have been measured for the first time in the IR spectral region (0.65 - 2.5 um) with sufficient spectral resolution and photometric precision to define mineral electronic absorption bands. The reflectance for all lunar regions observed (over 100 to present) continues to increase toward longer wavelengths to at least 2.5 um and several mineral absorption bands appear. The telescopic spectra are of similar quality and contain features similar to laboratory spectra for lunar samples. The absorption features in several spectra have been quantitatively analyzed using newly developed computer processing techniques, including thermal flux removal and absorption band fitting, to produce these mineral identifications. Detection and quantitative analysis of these absorptions provide a much improved basis for remotely determining and mapping surface mineralogy quantitatively from the ground or using airborne or spacecraft platforms. (Near-IR, spectral reflectance, remote sensing, lunar mineralogy).
J. Geophys. Res., Red, Paper 1B1174

6570 Surface (first km) of moon (mechanical properties, topography, albedo, etc.)
COMETARY IMPACT ON PLANETARY SURFACES
John D. O'Keefe and Thomas J. Ahrens (California Institute of Technology, Seismological Laboratory, Pasadena, California 91125)

The velocity flow fields, energy partitioning and ejecta distributions resulting from impact of solid and porous (fragmented) icy cometary nuclei with silicate planetary surfaces at speeds from 5 to 45 km/s are different than those resulting from the impact of silicate meteorites. The impact of 1 g/cm³ ice spheres onto an atmosphereless anorthosite planetary surface induces cratering flows that appear similar to those induced by normal density anorthosite meteorite impact. Both of these impactors lead to deep transient crater cavities for final crater diameters less than ~1 to ~10 km and for escape velocities ≤ 10⁵cm/s. Moreover the fraction of internal energy partitioned into the planetary surface at the cratering site is 0.6 for both ice and anorthosite impactors at 15 km/sec. As the assumed density of the hypothetical cometary nucleus or fragment cloud from a nucleus decreases to 0.01 g/cm³, the fraction of the impact energy partitioned into planetary surface internal energy decreases to less than 0.01 and the flow field demonstrates a toroidal behavior in which the apparent source of the flow appears to emanate from a disc or ring-like region rather than from a single point as in the explosive cratering case. The edge of the crater region are to several cases depressed and flow downwards, whereas the center of the crater region is uplifted. Moreover, the resultant post-impact particle velocity flow in some cases indicates the formation of concentric ridges, a central peak, and a distinct absence of a deep transient cavity. In contrast, transient cavities are a ubiquitous feature of nearly all previous hypervelocity impact calculations. The calculations of the flow fields for low density (0.01 g/cm³) impactors exhibited surface interface (comet-planet) instabilities. These are attributed to both the Rayleigh-Taylor and Helmholtz instability conditions and we believe that these occur in all flows for the impact of volatile low density (0.01 g/cm³) projectiles. It is speculated that these hydrodynamic instabilities can give rise to concentric rings in the inner crater region in large-scale impacts on planetary surfaces, although other mechanisms for their production may also act. The ejecta mass lost, versus, planetary escape velocity was computed and these results imply that the optimal escape velocity at which, as much material is lost as is being accreted from a planet, ranges from 1.2 to 2.15 km/sec for encounter speeds of 5 to 15 km/sec, with cometary impactors having a density of 0.01 to 1 g/cm³. These values compare to 0.83 and 1.5 km/sec for silicate impactors, thereby indicating that it is more difficult for volatiles than silicates to be accreted onto objects with escape velocities similar to the moon, Mercury and Mars. For objects, with escape velocities in the 0.1 to 1 km/sec range, the accretional efficiency for silicate and various porosity ices are similar whereas for objects with escape velocities < 0.1 km/sec the accretional efficiency of icy impactors become significantly lower than for silicate impactors.
J. Geophys. Res., Red, Paper 1B1249

Social Sciences

7310 Economics
STOCHASTIC STATE VARIABLE DYNAMIC PROGRAMMING FOR RESERVOIR SYSTEM ANALYSIS
David R. Maidment (Department of Civil Engineering University of Texas, Austin, Texas 78712) and Ven Te Chow.

The concept of state as used in state space modelling, dynamic programming, and Markov chain analysis is used to link these methods together. The random nature of inflows to the system is treated by incorporating a stochastic inflow model directly within the dynamic programming procedure. Transition probabilities found from the resulting stochastic dynamic programming are employed to determine the steady state probability distribution of the state and decision variables. As an example, the methodology is applied to determine operating policies for the proposed Watasheamu Dam in Nevada, U.S.A. Policies developed considering monthly flows as independently distributed, or as serially correlated, are similar over the normal range of flows but differ for very high and low inflows. Chance constraints applied at each stage of the dynamic programming are shown to limit the steady state probability of the storage being outside its desirable range, but reduce the average annual benefits of operation by up to 15%. Computer time requirements compare favorably with those of an equivalent deterministic analysis of the same system. (Dynamic programming, Markov chains, state space model, reservoirs).
Water Resour. Res., Paper 1W1196

Solar Physics, Astrophysics, and Astronomy

7710 Corona
MINOR IONS IN THE LOW CORONA
Joseph V. Hollweg (Space Science Center, Department of Physics, DeMeritt Hall, University of New Hampshire, Durham, NH 03824)

The ability of Coulomb friction to drag minor ions out of the subsonic region of the low corona is examined analytically. With some assumptions, we obtain new analytical expressions for the 'minimum proton flux' which is required to drag minor ions out of the corona, and for the velocity, relative to the protons, at which the minor ions are dragged out. We use these new results to suggest that the positive n_α/n_p vs. v_p correlation and the negative n_α/n_p vs. $n_p v_p$ correlation observed for solar wind helium at 1 AU are due to variations in the temperature of the low corona: hotter coronal regions produce solar wind flows which are slower but which have a greater proton flux density relative to cooler coronal regions, but because of the temperature dependence of the Coulomb friction the hotter coronal regions result in smaller values of n_α/n_p at 1 AU. We also suggest that the charge dependence of the Coulomb friction may lead to errors in determining the coronal temperature from measurements of the ionization state at 1 AU.
J. Geophys. Res., Blue, Paper 1A1197

A Mapping, Charting, and Geodetic Tour Through China

Owen W. Williams, Armando Mancini, and Lawrence F. Ayers

Defense Mapping Agency
Washington, D.C.

Introduction

For two weeks last December, we had the opportunity and privilege to visit the mapping, charting, and geodetic (MC&G) facilities in the People's Republic of China (PRC) as guests of the National Bureau of Surveying and Mapping (NBSM). There are two principal departments in the PRC that deal with the field of mapping: namely, the National Bureau of Surveying and Mapping, a civilian organization; and the Military Bureau of Surveying and Mapping (MBSM), which is the military MC&G counterpart. Both organizations have worked the national mapping program in China during the last 20 to 30 years.

Our tour was spent mostly with the NBSM and included visits with its provincial bureau in Guangzhou (Canton), the Wuhan College, the Research Institute in Beijing (Peking), and the Publishing House in Beijing. It also included a meeting with the NBSM headquarters' staff, also in Beijing; near the end of the tour we spent a full day with the Military Bureau.

The National Bureau of Surveying and Mapping

The main authority for MC&G in China rests with the NBSM. It employs some 24,000 workers and has bureaus in 29 provinces. Other groups in China such as the coal, agricultural, and forestry ministries also produce some special maps, but the NBSM establishes the specifications for mapping and provides the basic geodetic control and the topographic base. A division of the Civil Aeronautical Agency in China flies the photography for all mapping organizations.

In discussion with Li Tingzan, deputy director of NBSM, we learned that they, in partnership with the MBSM, had completed their national geodetic and astronomic networks, finished the 1:50,000 and 1:100,000 map coverage of China, and were now working on map revision for those scales as well as new 1:10,000 and 1:2,000 mapping. Li also stated that they had completed 9000 km of first-class leveling and that their second-order network was being reobserved because some markers had been destroyed during the Cultural Revolution. He estimated that the reobservation and reduction work would take about 10 years.

Relative to their national gravity program, the bureau indicated that the final 1° × 1° gravity anomalies would be finished by 1983. The gravity network is not yet tied to an international base, but they plan to achieve that tie by next year. No mention was made of the density of their gravity network.

In a subsequent session with the MBSM we were informed that 1:25,000 map coverage is also complete. Obtaining full coverage at 1:25,000, 1:50,000, and 1:100,000 throughout the country in three decades is truly an outstanding achievement. Li stated that when the two bureaus began the program, Chinese mapping was essentially nonexistent or completely inadequate.

Wuhan College

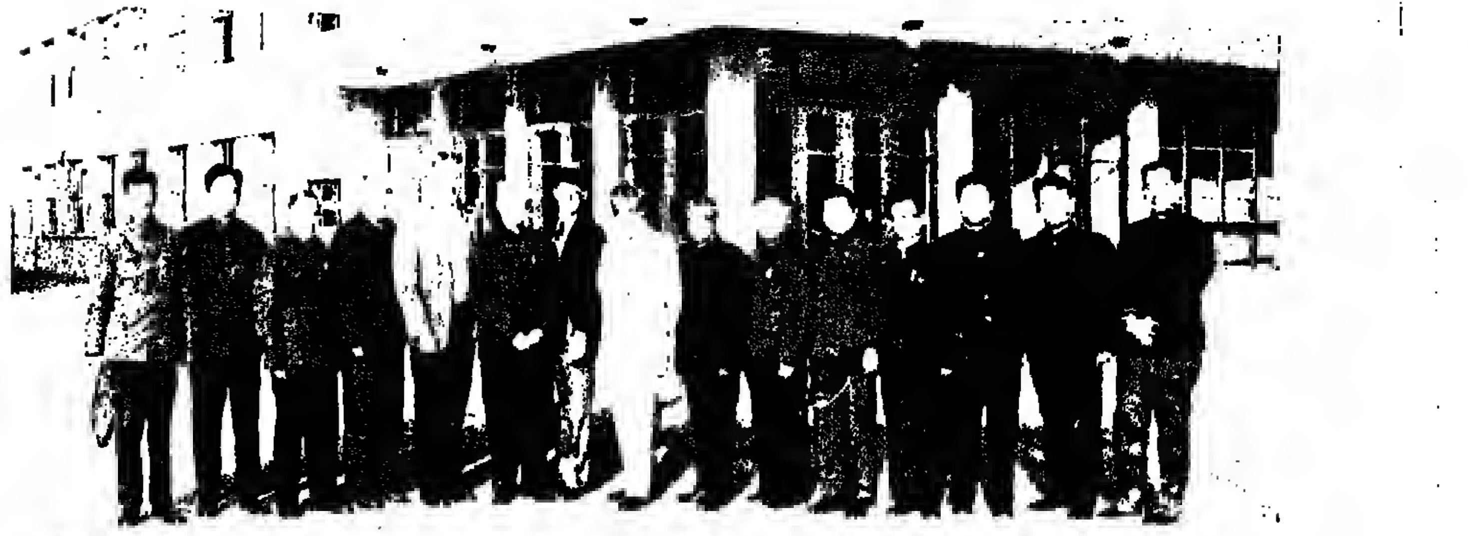
Wuhan College is a component of the NBSM. Situated in Hubei Province, the Wuhan College of Geodesy, Photogrammetry, and Cartography is one of the key institutions of higher learning in the PRC. It was established in 1956 by incorporating and reorganizing resources in surveying and mapping that were scattered among five universities and colleges in China. It operated as a single source in China for MC&G education until 1970 when the 'Gang-of-Four' activities forced the college to suspend operations. It reopened in 1974 with a new enrollment of students and has continued operations since that time.

The college now consists of six departments: surveying, photogrammetry, geodesy, cartography, optical surveying instrumentation, and electronic surveying instrumentation. Included in the geodetic curriculum are special courses in seismological measurements and specialties. The length of the undergraduate program is 4 years. The graduate program is 5 to 6 years or more. Each department has a research and development group, and R&D activities are overseen by the dean of research.

The teaching staff at this college consists of approximately 500 people. Among these are about 50 professors and associate professors, 275 lecturers, and a group of administrators and support personnel. Since its establishment in 1956, the college has graduated about 7000 students. Presently, the student body consists of 2000 men and women from numerous provinces and municipalities, plus a few from other countries.

One striking aspect of the college is its large number of laboratories and workshops. There are over 25 labs, all well equipped and spacious. Apart from the normal chemistry, electronic, and computer laboratories, the college also has excellent experimental facilities in instrumentation for laser rangefinders, infrared distancers, and optical theodolites and levels. In addition, there is a photogrammetric lab and astronomy and gravity laboratories. They fabricate most of their optical elements and machine most parts for their instruments. The machine shops are well equipped, and their large sizes suggest production output greater than expected for college programs. In fact, we learned later that the college undertakes minor, but special, industrial work also.

Visiting the various departments of the college, we noted that the school was well equipped with Chinese-built one- and two-drum presses, copy camera, photo labs, and a unique map photocopy system. The latter made an excellent one-to-one copy of a map to an accuracy of 0.2 mm in just 3 minutes. We were shown a series of hand-driven precision X-Y plotters—some made by Wild, Zeiss, and Jena and some Chinese made. We were briefed on their first effort to build an automatic cartography capability, which included an X-Y plotter and a computer. It was slow, but adequate to teach programming and basic principles to students.



With faculty at Wuhan College, Williams (left), Ayers, and Mancini flank their host, Wang Zhizhuo, vice president of the college. Li Quinghel, vice chairman of the academic commission of the college, is fourth from left.

A busy area at Wuhan College contains their Chinese-made computer. Shown are the paper tape and keyboard inputs with a teletype readout system.

Next we found a unique Chinese character name placement system, which operated very much like a microfiche reader. It included an exposure camera to photograph the characters when they came into the operator's view. Conventional techniques are used to teach students compilation scribing.

The area of photogrammetry was by far the most advanced, reflecting the impact of our host, Wang Zhizhuo, a photogrammetrist and vice president of the college. There were over 100 instruments of varying sizes, accuracies, and capabilities; many of them were made in China—some by the college, in its own optical and milling facilities. The equipment we saw included a TA-3D three-stage comparator, an X-2 stereocomparator, a Malergraph stereocomparator, Chinese monocomparators, a stereotope, a Zeiss C-8 stereoplanigraph, Chinese stereoplotters of many sizes and shapes, and Chinese rectifiers.

The college had a very complete set of surveying instruments, from the high precision T-4 down to construction-type survey instruments, levels, laser distance-measuring equipment, Doppler receivers, and gravity meters. We also learned that they had demonstrated a 10–20-μGal capability with their falling-body absolute gravity apparatus in Paris, France. We were shown the site of a planned new satellite geodetic facility.

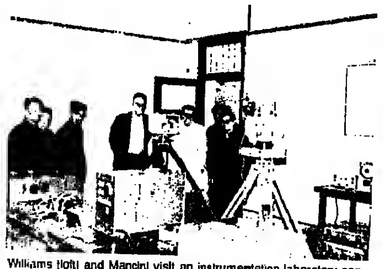
The school utilizes a Chinese-made computer, the T-260, with 32K memory and a paper tape and keypunch as inputs and a teletype readout system. Although not the latest vintage, the computer was used extensively by both the faculty and the students.

Another unique property of this college is its MC&G library. Here we found all the current literature on European, American, and Japanese science and technology. The library has a floor space of over 6000 m² and houses about 350,000 books and 660 types of periodicals and journals, Chinese and foreign.

Among scores of instruments in Wuhan College's Photogrammetry Department, Williams and Mancini found this three-stage comparator. Many of the instruments were made in China, some by the college in its own optical and milling facilities.

During the discussions, Li Quinglai, professor of geodesy and vice-chairman of the academic commission of the college, reported that China began to pay attention to developments in satellite geodesy in 1974, recognizing the important benefits it offered to the military and to the national geodetic networks. They since agreed that China should become active in the international satellite programs and should take steps to develop their people as well as the technology to take part in world programs.

Li added that the Chinese had studied every paper in MC&G available in the open literature. As part of their geodetic satellite program, they have purchased Magnavox and Marconi Doppler receivers and, in 1980, had observed 37 Doppler stations as an initial network across China. They currently have the GEODOP short-arc Doppler reduc-



Williams (left) and Mancini visit an instrumentation laboratory containing surveying angle and distance-measuring equipment.

EOS

TRANSACTIONS, AMERICAN GEOPHYSICAL UNION

The Weekly Newspaper of Geophysics

Send double-spaced manuscripts (four copies) to *Eos*, AGU, 2000 Florida Avenue, N.W., Washington, D.C. 20009, or send them directly to one of the associate editors with a copy to the above address.

Editor: A. F. Spilhaus, Jr.; **Associate Editors:** Claude J. Allegre, Peter M. Bell, Kevin C. Burke, Arnold L. Gordon, Kristine Katsaros, Gerard Lachapelle, Christopher T. Russell, Richard A. Smith, Sean C. Solomon, Carl Kisslinger; **News Writer:** Barbara T. Richman. **Editor's Assistant:** Sandra R. Marks; **Eos Production Staff:** Patricia Bangert, Margaret W. Conalley, Eric Garrison, James Hebblethwaite, Dae Sung Kim, Michael Schwartz.

Officers of the Union

J. Tuzo Wilson, President; James A. Van Allen, President-Elect; Leslie H. Meredith, General Secretary; Carl Kisslinger, Foreign Secretary; A. F. Spilhaus, Jr., Executive Director; Waldo E. Smith, Executive Director Emeritus.

Advertising that meets AGU standards is accepted. Contact Robin E. Little, advertising coordinator, 202-462-6903.

Eos, Transactions, American Geophysical Union (ISSN 0096-3941) is published weekly by the American Geophysical Union from 2000 Florida Avenue, N.W., Washington, D.C. 20009. Subscription available on request. This issue $5.00. Second-class postage paid at Washington, D.C., and at additional mailing offices.

Cover. A conceptual model of the cyclonic upwelling system, from an article by E. D. Traganza, J. C. Conrad, and L. C. Breaker. Extracted from AGU's latest publication, *Coastal Upwelling*, the first book in a new series, *Coastal and Estuarine Sciences*. Turn to page 661 for more details.

tion programs but are having some difficulty understanding parts of it because of inadequate documentation. That story sounded very familiar and all too common to us.

There is little doubt to us that the college is a fine institution. The faculty consists of the best-qualified scientists and engineers in the country, many with advanced degrees from Western universities. It is the only civilian MC&G college in the PRC. The vice rector, Wang Zhizhou, is a photogrammetrist, educated in England, and Li, mentioned earlier, is a geodesist, taught in the U.S. Their curriculum for the various programs appeared to us to be quite comprehensive, lacking somewhat only in the satellite geodesy area and perhaps in digital photogrammetry and digital mapping. Their facilities were better than found in most of our universities, except that some of the shop and laboratory equipment was not current vintage.

Research Institute

The Research Institute in Beijing, also an element of the NBSM, consists of 300 scientists and technicians organized into the disciplines of geodesy, cartography, photogrammetry, information sciences, and computer technology.

A tour of the facility showed us a newly installed Kodak microfiche system consisting of an MRG-1 Recordak, a versamat processor, an enlarging camera, and a microfiche storage and retrieval system. We noted that DMA and the development laboratories had not yet found a suitable system for microfilming maps to retain the detail and accuracies we required.

We were also briefed on an automated cartography program that the Institute had just started. It included a stereoplotter with digital pickoffs and an X-Y flatbed plotter for outputting contours on a scribe coat. The system, an adaption of electronic servos to existing plotters, was slow and used punched paper tape to drive the plotters. The tape input was not very efficient, but the scribing results looked extra good.

Their computer facility included a DJS-6 192K memory floating point system which used punched tape as input and a drum plotter as output. Made in China, the system used Fortran and ALGOL language. It is used for scientific computations and digital cartographic processing.

The geodetic portion of the tour included a walk-through briefing of their Marconi Doppler receiver laboratory, a new Hewlett-Packard minicomputer, and a clock fabricated by them for use in a satellite optical tracking system. The Research Institute also makes its own high-quality film coatings for photogrammetric and cartographic processing.

The Chinese-built clock at the Research Institute at Beijing is used in a satellite optical tracking system.

Zheng Zhidn, the vice director, and members of his staff repeated Chinese intentions to become more involved in satellite geodesy, adding that they looked to the United States as the leader in this field. Also, they had just started to investigate remote sensing and digital cartography. They were looking forward to Landsat-D and exploitation of imagery received from their ground station.

We remarked to Zhang that the R&D program in the institute seemed somewhat lacking in theoretical work. They agreed and said they had taken steps to broaden it.

Guangzhou Provincial Bureau

The Surveying and Mapping Bureau of Guangzhou (Canton) Province is under the direction of Luo Tong. Started in 1975, this bureau has 900 employees, including 140 professional engineers, cartographers, and technicians. It is organized into one aerial photogrammetric unit, two field units (with 11 teams each), one instrument repair unit, and a printing and graphic unit.

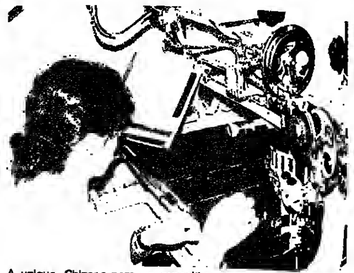
Even though China has been mapped at 1:50,000 and 1:100,000 scale, the provincial mapping agencies perform the very large scale mapping and provide the data for the 1:50,000 and smaller-scale revision work.

The primary map production and some of the instrumentation used by the provincial bureau include 1:10,000 scale maps, using 1:3,500 scale aerial photos; 1:2,000 scale maps, using 1:800 scale aerial photos; 1:500 scale maps; city maps of varying scales; Wild B-8s; a Wild stereocomparator; Wild marking instruments; and rectifiers.

We were impressed with the quality of work done at the Guangzhou Province. It was well equipped, photogrammetrically, and its photographic imagery was of high quality. We did not observe first hand their surveying teams or their printing facility, but from the quality of the field notes and printed maps it was apparent that the government placed a high priority on mapping.

Publishing House

The Publishing House of the National Bureau of Surveying and Mapping is headed by Shen Jing Zhi, and it has a



A unique Chinese-name composition system was found at the Publishing House. It utilizes an exposure camera to photograph the thousands of characters as they come into the operator's view, working very much like a microfiche reader.

staff of 500 people, of which 18 are professionals. Established in 1950, the Publishing House was organized along product lines, including world maps, China maps, school maps, tourists maps, and a printing plant.

They publish over 100 maps and atlases a year—40 million sheets—and use 3000 tons of paper. Maps are distributed through the International Book Stores and school systems of China. We were very impressed with the quality of their workmanship, particularly the work of two artists who produced the shaded relief maps.

The Military Bureau of Surveying and Mapping

We spent one day with the Military Bureau. Zhu Yiyu, the deputy director, said the Military Bureau was formed in 1950 and was chartered with the responsibility of surveying and mapping China. He informed us that the mapping program has taken 30 years to complete, with the combined efforts of the military and national bureaus, but that they had completed the 1:25,000- to 1:100,000-scale coverage of China with a good geodetic and level network. Zhu stated that the National Bureau is now working the 1:10,000 and larger map scales, and the Military Bureau is revising and recompiling the 1:25,000 and smaller-scale maps.

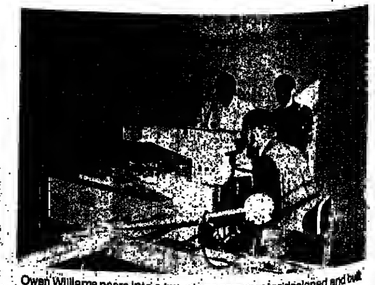
He also said that the Navy Surveying and Mapping Department produces ocean charts and that the Air Force Surveying and Mapping units make aeronautical charts. Their charts, incidentally, are mostly finished and are now in a revision cycle.

The Military Bureau performs first-, second-, and third-order geodetic triangulation, using traditional procedures and theodolites (T-2, T-3, etc.). Their distances were measured by using 'invarmeters' in the 1950's, but in the 1960's they imported, and now use, electronic distance measurement instruments. They have built their own T-4 theodolite and are automating it with an image tube in its focal plane. Their first-, second-, and third-order vertical networks are based on mean sea level of the Yellow Sea. They have finished the first- and second-order gravity network and are presently densifying it. Also, the military and national bureaus are currently testing optical and radio observations in satellite geodesy. Presumably, the electronic observations are related to their Doppler program.

The Military Bureau uses photogrammetry extensively in its mapping programs. The films used are high-contrast, black-and-white imagery, with a current image format of 18 × 19 cm, but they are converting to a 23 × 23-cm format. They use their own computers to perform photogrammetric triangulation adjustments. Some of their maps are in one color, but most are five. The Military Department uses scribing methods for color separation. They use electrosegregation printers in map reproduction as well as litho processes.

The Military Bureau also has a research institute, which is located in Shenxi Province. It was established in 1960. This institute also has departments in geodesy, photogrammetry, cartography, and information sciences. We did not visit there, but we were told that they currently are testing methods for connecting islands to the mainland through the use of laser and Doppler techniques. Their research also includes methods for automating mapmaking.

Also a part of the Military Bureau is a surveying institute, located in Chengdu, Hunen Province. There they train personnel in the fields of geodesy, photogrammetry, and cartography in a 4-year undergraduate program and a small graduate program. From the description given to us, we as-



Owen Williams peers into a two-stage comparator designed and built by the Chinese.

sume that this institute is comparable to Wuhan College.

Like the NBSM, the Military Bureau also employs over 20,000 people in MC&G.

Conclusions

We cannot draw definitive conclusions on the MC&G posture in PRC from just a single visit and the few conference discussions we had. However, based on what we observed and heard, the status of mapping in China is in better shape than programs in many other countries. The map sheets we examined showed a high degree of cartographic quality, and presumably, their geodetic integrity is equally good. China's national gravity network is near completion, and its triangulation schemes were adjusted through an extensive network of astrogeodetic observations. Their present programs in mapping and geodesy are mainly maintenance types, with emphasis on new production in larger-scale maps (1:10,000 or larger) in the provinces for better land utilization purposes.

Having accomplished these major programs during the last 30 years with conventional techniques and equipments, our Chinese colleagues are eager to expand their capabilities with newer technology in their production plants. Further, they feel strongly that China must join with other countries in global geodesy and geophysics. They have built their own laser systems and wish to learn more from us about this technology along with VLBI and other instrumentation. Li, accompanied by other scientists and engineers, recently made a visit to the U.S., arranged through the University of Maryland, to inspect first-hand some of this technology.

Existing Chinese MC&G production technology is not the most current, but it is our impression that a modern capability could be achieved within a decade through selective acquisitions of equipment in parallel with training and educational programs.

As for the social side of the trip, there aren't adequate words to express our reaction to the Chinese friendliness and graciousness. They extended every possible courtesy to us, and we returned home feeling we had gained many new friends. They are SUPER people.

Lawrence F. Ayers is the deputy director for programs, production, and operations at the Defense Mapping Agency. He received his B.S. from Virginia Polytechnic Institute, Blacksburg, Va., and his M.A. from the University of Indiana, Bloomington. He has served as chairman of the Research Committee of the American Society of Photogrammetry, director of the American Congress on Surveying and Mapping, and member of the Scholarship Committee of ACSM.

Armando Mancini is deputy director for systems and techniques at the DMA. He received his B.S. in geology from West Virginia University, Morgantown; did graduate work in mathematics at both American and George Washington Universities, Washington, D.C.; and received his Ph.D. in astronomy from Georgetown University, Washington, D.C. He has coedited an AGU monograph on 'Uses of Artificial Satellites for Geodesy' and edited a DOD contribution for a book on the National Geodetic Satellite Program.

Owen Williams is deputy director for management and technology, Defense Mapping Agency. He received his B.A. from Kalamazoo College, Kalamazoo, Mich., and then pursued his M.A. at George Washington University, Washington, D.C. He has served as a visiting lecturer in earth sciences in Europe and Scandinavia and served as a guest lecturer on oceanic geodesy at the Soviet Academy of Sciences.

News

Voyager 2: More Puzzles, More Applause

Kinked rings, a hamburger-shaped satellite, and swirling equatorial storms on Saturn added up to a Voyager 2 encounter dubbed 'a 200% success' by project scientist Edward C. Stone. Despite problems with the spacecraft's scan platform, the mission sent scientists scurrying back to their laboratories to sort through a plethora of data, including more than 17,000 photographs, which streamed back to earth from more than a billion miles away. Some early findings, such as the absence of tiny moonlets embedded in the rings, perplexed Voyager scientists; other discoveries, such as detailed information provided by the photopolarimeter on the ring structure, incited wild celebration. Detailed analysis will take months and, for some experiments, years. Here are some preliminary results from Voyager 2's Saturn encounter.

The most striking of the photographs sent back to earth in November by Voyager 1 (*Eos*, *61*(49), 1201) were those of Saturn's rings. The Voyager team, hoping to learn more about how the rings were formed and how they remain discrete, reprogramed Voyager 2's computer commands to hone in on the rings. But the close up views relayed to earth did not always answer the questions provoked by the earlier mission.

The closer we look at the rings, the more puzzling things are, said Stone. One such puzzle was the lack of moonlets within the rings. According to the resonance theory elaborated upon after the Voyager 1 flyby, hundreds of moons should have been embedded in the rings, preventing the ring material from merging into one giant ring. Curiously, no such moonlets were found in the initial review of Voyager 2 photos.

Another surprise was the kinked ring seen within the Encke division. Coined the 'kinky Encke' by Bradford A. Smith of the University of Arizona and Voyager imaging team leader, the thin structure may be able to provide clues about the *F* ring, according to Jeff Cuzzi, another member of the imaging team. In the Voyager 1 photographs, the *F* ring appeared to have three intertwined strands, draped around Saturn like a thin gold necklace. Scientists hoped to get more detailed pictures of the ring—including a false stereoscopic view—but mechanical problems with the spacecraft's scan platform prevented this. From the photographs Voyager 2 did relay to earth, though, the *F* ring appears to have five strands; but the 'braided' effect was not seen.

There were more rings than had been thought previously. Instead of hundreds, Voyager scientists now believe there are literally thousands of ringlets comprising the rings.

Within the large *B* ring lightning was detected. The lightning, 100,000 times more potent than that on earth and capable of generating between 100 and 1000 MW, occurs in the same regions where the 'spokes' have been observed. These spokes, or dark radial streaks across the rings, were detected last year during the Voyager 1 journey to Saturn. One theory to explain the spokes involves the excitation of small ring particles by the planet's magnetic field. Although there is no definite correlation between the lightning and the spokes, it is difficult to believe that the lightning discharge is not involved with the formation of the spokes, according to a spokesman at the Jet Propulsion Laboratory.

The successful occultation, or eclipse, of the star Delta Scorpii by Saturn's rings was cause for jubilation for Arthur L. Lane and his photopolarimetry team. The photopolarimeter was able to count the ringlets and determine the gap between them. The instrument, measuring the star's light as it winked through the ring material, mapped the rings with an accuracy of a city block. The photopolarimeter had failed to operate on Voyager 1.

Satellites in Focus

Voyager 2 got closer to the moons Hyperion, Iapetus, Enceladus, and Tethys than did Voyager 1. High-resolution photographs of these satellites enabled scientists to focus on deep craters, rift valleys, tectonic traces, and oddly shaped satellites.

'Before the mission we would have said Hyperion was a relatively uninteresting object. It has now become an extraordinarily interesting object,' said Brad Smith. The satellite, third outermost of Saturn's known moons, appeared to be shaped differently in different photographs. Hal Masursky, of the U.S. Geological Survey and a member of the Voyager imaging team, compared Hyperion's shape to that of a hamburger patty. Other scientists likened Hyperion to a beer can, a candy bar, and a banana. The oblong satellite's long axis does not point toward Saturn, as would be expected for a stable rotation. Instead, Hyperion's axis points about 45° higher. One explanation is that something may have crashed into the satellite millions of years ago, causing it to wobble in its orbit.

Iapetus is the Janus-faced satellite whose leading hemisphere appears about 15 times darker than the trailing hemisphere. The darker side may be dusted with material that was chipped, through the ages, from Phoebe, according to one theory, while the trailing, ice-covered, lighter side may simply be reflecting sunlight off the surface. Another hypothesis is that Iapetus is partially composed of frozen methane. The moon's leading side may be dark because methane, the Voyager 2 team had plans to program platform movements for Voyager 2's closest approach on September 4 to Phoebe, Saturn's outermost moon.

Although dust particles were thought to be the root of the balking platform, the latest word from the Jet Propulsion Laboratory, which manages the Voyager program, is that a mechanical problem developed in the gearbox and caused the scan platform to stick.

Lost because of the platform problems were some photographs of Saturn's rings, temperature measurements of the planet's southern hemisphere, some ultraviolet experiments, the occultation by the photopolarimeter of the star Beta Tauri, and pictures of the moons Rhea and Titan.—*BTR* ◆

Wanted: Aid to OES

The National Research Council's Office of Earth Sciences (OES) and the office's advisory board are anxious to have the assistance of earth scientists in advancing the office's work, according to a recent statement by John C. Crowell, OES chairman. He identified the responsibilities of OES as continued awareness and active concern for the health of the earth sciences; identification of opportunities for the earth sciences in meeting national needs; and fostering awareness of scientific advances that may help to resolve national problems. Crowell invited atmospheric, oceanographic, and solid-earth scientists to suggest activities at the national level to the office and its advisory board.

The OES uses the solicited suggestions to complement its perception of important national topics that need attention. Research is not supported, but the suggestions receive attention in several ways, Crowell explained. They are sent to appropriate units of the National Research Council when related activity is underway. In some cases, a suggestion may result in the establishment of an inde-

pendent committee to study and report on the topic. For example, a report is being prepared on the geological aspects of industrial waste disposal. Such reports are usually read by government officials, scientists in the field, and the public.

Crowell said that effective reports can increase support of the scientific and technological community, expand public awareness of particular topics, and initiate or change the emphasis of federally supported programs.

Suggestions should be sent to Crowell, Chairman of the Office of Earth Sciences, National Research Council, National Academy of Sciences, 2101 Constitution Avenue, N.W., Washington, D.C. 20418. Statements should include sufficient information for the advisory board to evaluate the topic's national significance. ◻

Geophysical Events

This is a summary of *SEAN Bulletin, 6*(7), July 31, 1981, a publication of the Smithsonian Institution. The complete bulletin is available in the microfiche edition of *Eos*, as a microfiche supplement, or as a paper reprint. For the microfiche, order document number E81-005 at $1.00 from AGU, 2000 Florida Avenue, N.W., Washington, D.C. 20009. For reprints, order *SEAN Bulletin* (give dates and volume number) through AGU Separates. $3.50 for the first copy for those who do not have a deposit account; $2 for those who do; additional copies are $1.00. Orders must be prepaid.

Volcanic Events

Mt. St. Helens (Washington): Occasional ash plumes to 3 km altitude.

Gamkonora (Indonesia): Tephra ejection; more than 3500 flee briefly.

Kilauea (Hawaii): Intrusion under S summit area and SW rift zone.

Etna (Sicily): Ash ejection, probably caused by central crater collapse.

Tiatia (Kurile Is.): Vapor emission and glow.

Langila (New Britain): Vulcanian explosions and glow continue; seismicity intensities.

Manam (Bismarck Sea): Ash emission continues.

Karkar (Bismarck Sea): New fumaroles and hot springs.

Sakurazima (Japan): Explosions decline; seismic and eruptive activity since 1978 summarized.

White Island (New Zealand): Volcanic seismicity declines; no sign of tephra ejection since May.

Bulusan (Philippines): No eruption follows earthquake swarm.

Mayon (Philippines): Mudflow casualties updated.

Central America: Gas analyses at three volcanoes.

Atmospheric effects: Volcanic material below the tropopause over NW North America in mid-July; source unknown.

Mt. St. Helens Volcano, Cascade Range, Southern Washington, USA (46.20°N, 122.18°W). All times are local (GMT–7 h). The mid-June extrusive episode added a new lobe roughly comparable in volume to lobes empleced during previous episodns last October, December–January, February, and April that built the preexisting composite domo. A continuously recording tiltmeter located about 30 m from the NE margin of the dome provided date on preextrusion uplift and probably recorded the beginning of extrusion at about 1700 on June 18. This tiltmeter was destroyed early June 23, but three new tiltmeters were installed in early July, within 100 m of the NE, E, and SE sides of the dome. None showed any significant changes through July. Other July deformation measurements did not show the accelerating outward movement that has typically preceded extrusion episodes. The volume of SO_2 emissions, measured by COSPEC from fixed-wing aircraft flying under the plume, usually ranged from 100 to 300 tons per day during July, averaging about 150 tons per day. Through the end of July there was no suggestion of the increase in SO_2 emissions that preceded both the December 1980 to January 1981 and the June 1981 lava extrusion episodes by several weeks. Poor weather prevented sufficient SO_2 measurements to determine trends before other extrusion episodes.

Occasional steam and ash emissions were observed during July and early August. An ash-laden gas plume rose to nearly 3 km altitude at 1453 on July 9, accompanied by seismicity. A small ash plume just cleared the rim of the crater at 1138 on July 14, and other plumes, accompanied by seismicity, were seen by U.S. Geological Survey field crews at about 0845, 0948, 1442, and 1805 on July 15, the largest of which reached about 3 km altitude. A plume emerging from the February lobe of the composite dome reached 3 km altitude at 1257 on July 18. Light ashfall was reported at Cougar, about 15 km SW of the summit, between 0800 and 0900 on July 27; this ash may have been ejected during a period of seismicity recorded at 0750. Five minutes of low-level tremor accompanied weak gas emission at 1605 on July 28. An ash-laden plume rose to more than 3 km altitude at about 1805 on July 30, accompanied by a seismic event and followed by about 5 min of low-level tremor. Several episodes of very low-level tremor were recorded August 1–2. A characteristic burst of seismicity accompanied a plume, recorded on U.S. Forest Service video equipment at 0735 on August 2, that appeared to be ash-laden and rose to about 3.5 km altitude. Several moderate seismic bursts of about 1905 on August 3 accompanied a small ash plume that reached 3.5 km altitude according to Portland Airport radar; 7 min of moderate tremor followed this ash emission. A small ash-laden gas emission occurred at 1133 August 4.

Information contacts: Dan Dzurisin, Chris Newhall, and Don Swenson, USGS Field Office, 301 E McLaughlin, Vancouver, Washington 98663; William I. Rose, Jr., Department of Geology and Geological Engineering, Michigan Technological University, Houghton, Michigan 49931; Christine Boyko, Steven Malone, Elliot Endo, and Craig Weaver, Graduate Program in Geophysics, University of Washington, Seattle, Washington, 98195; Robert Tilling, USGS, Stop 906, National Center, Reston, Virginia 22092.

Gamkonora Volcano, Halmahera Island, Indonesia (1.38°N, 127.52°E). All times are local (= GMT + 9 h). Explosive activity from Gamkonora's summit crater began about 0900 on July 19. The eruption apparently began with the ejection of incandescent tephra, followed by about 1½ hours of ash emission. An eruption cloud rose about 700 m, and ash fell as far as 5 km S of the summit, where 1–1.5 mm accumulated. Occasional felt earthquakes continued after the July 19 ash ejection ended. More then 3500 people fled the area.

Smaller explosions occurred on July 22 at about 0400 and 1800, accompanied by booming noises heard in a village at the NNW foot of the volcano, 5 km from the summit. Glow was visible over the crater at night. A Volcanological Survey of Indonesia team arrived on the island immediately after the second explosion. After the team issued an evaluation, the evacuees returned to their homes.

Local officials reported that the summit crater had occasionally emitted thick 'smoke' since March. Gamkonora's last eruption, from mid-July through early October 1952, also consisted of explosive activity from the summit crater.

Information contacts: Adjat Sudradjat, Director, and Dr. Suparto and Dr. Suratmen, Senior Volcanologists, Volcanological Survey of Indonesia, Diponegoro 57, Bandung, Indonesia; Antara News Agency; Agence France-Presse.

Kilauea Volcano, Hawaii, USA (19.37°N, 155.22°W). All times are local (= GMT – 10 h). The following is a report from the Hawaiian Volcano Observatory (HVO).

'On August 10–11 seismographs and tiltmeters at the HVO recorded a moderate intrusion at Kilauea Volcano. The event was characterized by an earthquake swarm and harmonic tremor, accompanied by deflation of the summit and ground cracking. As of 0800, August 11, an estimated 30–50 million m^3 of magma intruded into the S summit and SW rift zone of Kilauea. The activity started with an increase of micro-earthquakes in the S summit area at 0330, August 10. Shortly before 0430, tiltmeters recorded the onset of the sharp deflation of the summit. By 0500 the seismic intensity increased and maintained a continuous state of activity. Micro-earthquakes and harmonic tremor less than 5 km in depth indicated that magma was migrating from the summit to the SW rift zone in the vicinity of Kamakale Hills nearly 20 km away. At midmorning August 11 several thousand earthquakes of magnitude equal to or less than 4.5 Ms were detected, and monitoring instruments continued to record a diminishing pattern of seismicity and ground tilt.'

Information contact: Reggie Okemura, USGS Hawaiian Volcano Observatory, Hawaii Volcanoes National Park, Hawaii 96718.

Tiatia Volcano, Kunashir Island, Southern Kurile Islands, USSR (44.35°N, 146.25°E). The crew of a Japanese fishing boat cruising near Kunashir island observed 'smoke' rising from Tiatia June 10. During the night of June 24, an orange glare was observed in the direction of the volcano from the Nemuro Observatory, 120 km away. No additional activity has been reported.

Vapor columns from Tiatia were seen, and an explosion from the vicinity of Tiatia was heard (while the volcano was obscured by foggy weather) in late July 1978 (see *SEAN Bulletins, 3*, (7–8). Tiatia's last reported strong activity was a flank eruption in July 1973.

Information contact: Kyodo Radio, Tokyo, Japan.

Earthquakes

The July 8 and July 15 earthquakes occurred in the SW Pacific Ocean. No damage or injury was reported for the first, which occurred in open ocean about 250 km SE of the Loyalty Islands. The second, centered about 100 km WNW of Vila, the Vanuatu capital, was felt there and caused some damage in the Shepard Islands, about 50 km N of Vila. In Iran, the original government-estimated casualty toll of 8000 was revised to 1500 dead and 1000 injured. The July 28 shock occurred in Kerman Province, about 80 km ESE of the provincial capital of Kerman and within 30 km of the 8.9 M_s earthquake of June 11 in which about 9000 persons died.

Information contact: National Earthquake Information Center, U.S. Geological Survey, Stop 967, Denver Federal Center, Box 25048, Denver, Colorado 80225; Fred Cole, Department of State, AID/OFDA, Washington, D.C. 20523; The New York Times; Reuters News; United Press International.

Meteoritic Events

Meteorite: Oregon, May 11 or 12; a brecciated chondrite.
Fireballs: SE Virginia, SW Pennsylvania, N Italy.

Date	Time, GMT	Magnitude	Latitude	Longitude	Depth of Focus	Region
Jul 6	0306	7.0 M_s	22.28°S	171.73°E	shallow	Loyalty Is
Jul 15	0759	7.1 M_s	17.30°S	167.59°E	30 km	Vanuatu Is
Jul 28	1722	7.3 M_s	30.09°N	57.84°E	shallow	SE Iran

Geophysicists

Gordon D. Bennett, a hydrologist with the USGS in Reston, Va., is this year's recipient of the O. E. Meinzer Award of the Geological Society of America. Bennett is the acting chief of the USGS ground water branch.

Harold D. Craft, Jr., a senior research associate and director of operations for the Arecibo Observatory in Puerto Rico, has been appointed acting director of the National Astronomy and Ionosphere Center at Cornell University.

Thomas Gold finished his term on June 30 as director of Cornell University's Center for Radiophysics and Space Research. *Edwin E. Salpeter* is the new director. Gold will continue as the John L. Wetherill Professor of Astronomy at Cornell and will concentrate his research efforts on the detection of hydrocarbons in the earth.

Willard A. Murray has joined the Oemes & Moore San Francisco office as a senior hydrologist.

Vujica Yevjevich, director and professor of the International Water Resources Institute at George Washington University, was awarded an honorary membership in the International Association for Hydraulic Research.

Chow

Ven Te Chow, 61, former president of AGU's Hydrology Section, died on July 30, in Urbana, Ill. He was professor of civil and hydrosystems engineering at the University of Illinois at Urbana-Champaign. Chow, an AGU Fellow, was a founder and the first president of the International Water Resources Association; later he became honorary president. Chow was known for his many activities in hydrology and water resources. He was the founder of and delegate to the Universities Council on Water Resources, lecturing adviser to the Central Water and Power Commission of the Government of India and to the Power Resources Administration of the Government of Turkey, a member of the NASA study group on Space Application of Earth Resources, and an international consultant.

New Publications

An Introduction to Mineralogy for Geologists

W.J. Phillips and N. Phillips, John Wiley, New York, xiv + 352 pp., 1980, $49.50

Reviewed by Richard A. Yund

The study of mineralogy has embraced many new topics in the last 20 years and often includes a materials science approach to old and new problems. Some of the major advances in recent years include (1) techniques for rapid structure refinement and their use to explore fundamental mineralogical and petrological problems, (2) a wealth of new information from transmission electron microscopy about microstructural relations such as exsolution, antiphase domains, and dislocations, (3) determination of structure controlled properties and behavior such as volume diffusion and deformation mechanisms in minerals, (4) determination of detailed phase relations including the mechanisms and kinetics of these changes, and (5) new approaches to atomic bonding in minerals. These and other recent advances in mineralogy are largely ignored in existing mineralogy textbooks, and the book by Phillips and Phillips continues this tradition.

Crystallography will continue to occupy a central role in mineralogy, but the emphasis in this book is largely on external symmetry and crystal morphology. Although this may be useful for someone wanting to orient a crystal to measure one of its physical properties, it is not essential to the general reader who wants to know how crystallography and crystal structure relate to mineralogical properties and relations.

Given the topics the authors have chosen to include, their presentation is clear, although uneven in the level of treatment. The first three chapters deal largely with the external features or properties of minerals including crystal morphology. Chapter 4 is an unusual mixture of an introduction to lattices and atomic close packing. Chapter 5 is entitled 'Crystal Chemistry,' but it is mostly concerned with an elementary discussion of the atom and types of bonding. The next chapter treats the nature of X rays, but includes only a very brief discussion of X ray diffraction.

The next two chapters consider the structures of halite, fluorite, diamond, sphalerite, and pyrite and contain material not found in most elementary texts. The general idea of these chapters is good, and the chapters include a discussion of how simple mineral structures are determined. However, this is done without the aid of space groups and equipoints (chapter 9, four pages long) and only qualitative use of X ray intensity data. The next five chapters deal primarily with stereographic projections of crystals with applications to zircon, cassiterite, barite, olivine, orthoclase, hornblende, augite, and albite in order to have a representative example from each crystal system. The reader who is learning about mineralogy for the first time is not likely to find the material in these five chapters useful or interesting. Chapter 16 very briefly considers crystal growth and twinning, but the level of treatment is superficial. The last chapter is concerned with the structures of the common silicate minerals and probably represents the most useful part of the book on mineralogical relations. Again, however, the treatment is too brief to be very useful.

There are four appendices that are devoted to (1) answers to questions, (2) the construction of crystallographic axes, (3) the X ray powder method of mineral identification, and (4) mineral identification tables.

In summary, the title of this book belies its contents. The authors have defined mineralogy in a very narrow crystallographic sense and have not even emphasized some of the more important aspects of crystallography and crystal structure relations. Furthermore, there is no attempt to include the important and exciting results from most of the mineralogical research in the last 20 years. As a text, it may find limited usefulness in a specialized laboratory course, but it will not provide the general reader with modern mineralogical concepts, which are necessary for understanding a broad range of geological and geophysical problems.

Richard A. Yund is with the Department of Geological Sciences, Brown University, Providence, Rhode Island.

Classified

EOS offers classified space for Positions Available, Positions Wanted, and Services, Supplies, Courses, and Announcements. There are no discounts or commissions on classified ads. Any type that is not publisher's choice is charged for at display rates. EOS is published weekly on Tuesday. Ads must be received in writing on Monday 1 week prior to the date of the issue required.

Replies to ads with box numbers should be addressed to: Box ____, American Geophysical Union, 2000 Florida Avenue, N.W., Washington, DC 20009.

POSITIONS WANTED
Rates per line
1-5 times—$1.00, 6-11 times—$0.75, 12-26 times—$0.55

POSITIONS AVAILABLE
Rates per line
1-5 times—$2.00, 6-11 times—$1.60, 12-26 times—$1.40

SERVICES, SUPPLIES, COURSES, AND ANNOUNCEMENTS
Rates per line
1-5 times—$2.50, 6-11 times—$1.95, 12-26 times—$1.75

STUDENT OPPORTUNITIES
For special rates, query Robin Little, 800-424-2488.

POSITIONS AVAILABLE

University of New Orleans/Geophysicist. Applications are invited for a permanent faculty position commencing August 1982, in exploration geophysics. The Ph.D. or equivalent experience is required.

Appointee will be expected to teach graduate and undergraduate courses in geophysics and general geology, conduct a program of research, supervise theses and oversee a program in geophysics. The position will be at the assistant professor level or higher depending on background. Applications are encouraged from individuals with industrial experience, including recent retirees.

Applicants should send a letter outlining interest in position, complete résumé, and three letters of recommendation to Dr. Gordon Frey, Department of Earth Sciences, Lake Front, University of New Orleans, New Orleans, LA 70122.

UNO is an equal opportunity/affirmative-action employer. Applications from minority groups are specifically invited.

Engineering Geologist/Geophysicist. The Department of Geological Sciences, University of Saskatchewan, has a vacant tenurable position in engineering geology/geophysics. Applicants should be qualified to teach undergraduate and graduate courses and to conduct research in engineering geology. A background in structural geology may be appropriate. Well-equipped facilities are available for research in rock mechanics, fluid flow through porous media, acoustic, and electrical properties of rocks, and permafrost. Good opportunities exist for joint research with qualifications and experience. Send applications, detailed personal resume including the names of at least three referees, and other supporting data to Dr. W.G.E. Caldwell, Head, Department of Geological Sciences, University of Saskatchewan, Saskatoon, Saskatchewan, S7N 0W0.

Please note: until November 15, 1981 consideration will be given only to applicants who are Canadians or landed immigrants, after that date all applications will be considered.

Faculty Positions/The University of Iowa. The Department of Physics and Astronomy anticipates one or two openings for tenure-track faculty in August 1982. One or more visiting professorships, at any rank, are also expected to be available. Preference will be given to candidates with research activity in the following experimental and theoretical areas: astronomy, astrophysics, atomic physics, condensed matter physics, elementary particle physics, nuclear physics, plasma physics, and space physics. The positions involve undergraduate and graduate teaching, guidance of research students, and personal research. Interested persons should send a résumé, a statement of research interests, and the names of three professional references to Search Committee, Department of Physics and Astronomy, The University of Iowa, Iowa City, IA 52242.

The University of Iowa is an equal opportunity/affirmative action employer.

Research Positions/Seismology. Applications are invited for two possible research positions in the Institute for Geophysics, University of Texas at Austin, an equal opportunity employer.

Both positions involve field work on seismograph networks in Latin American countries, analysis and interpretation of data acquired from these networks and related seismological studies in the Caribbean and South America.

One Ph.D. level and one B.S./M.S. level positions are available. Salary for either position will be arranged depending on experience. Please send Resume and bibliography to Toshimitsu Matumoto, Institute for Geophysics, University of Texas at Austin, 700 The Strand, Galveston, Texas 77550.

University of California, Santa Barbara/Assistant Professor of Geography. Tenure track position available July 1, 1982. Ph.D. required prior to appointment. Strong commitment to research and teaching and good background in computer and mathematical quantitative skills required. Major area of specialization should be cartography with other research and teaching interests in human geography. Submit resume, bibliography, and names of three referees to: Dr. Reginald G. Golledge, Chairman, Department of Geography, University of California, Santa Barbara, CA 93106. Closing date: December 31, 1981.

Equal opportunity/affirmative action employer.

Space Physics Research Position. Applicants with background in interplanetary space, auroral and magnetospheric research, and/or space instrumentation are sought. Successful candidates will work with ISEE particle data and/or with auroral X-ray imaging research that uses the newly developed X-ray cameras. These positions have not been filled and are available now. Send your resumé to Professor George K. Parks, Space Sciences, Geophysics Program, University of Washington, Seattle, WA 98195.

The University is an equal opportunity employer.

EARTH SCIENCES

The Lamont-Doherty Geological Observatory of Columbia University invites scientists interested in any field of the earth sciences to apply for the following fellowships: two postdoctoral fellowships, each awarded for a period of one year (extendable to two years in special instances) beginning in September 1982 with a stipend of $22,500 per annum. Completed applications are to be returned by January 15, 1982. Application forms may be obtained by writing to the Director, Lamont-Doherty Geological Observatory, Palisades, New York 10964. Award announcements will be made February 28, 1982 or shortly thereafter.

The Observatory also welcomes applications from candidates for postdoctoral research associate positions in the discipline.

Computer Programmers. Looking for computer programming talent, all experience levels, for selected locations around the country. Call Dr. Wayne Mount at (617) 259-9585 to obtain details, and/or send resume to: GAC, Box 177, Lincoln, MA 01773

Geophysical Fluid Dynamicist/Physical Oceanographer. Applications are solicited for a junior faculty position in ocean physics or dynamics to begin in the academic year 1982–83. Areas of interest to the Department include analytical, numerical and laboratory modeling of physical processes and phenomena in the sea.

Yale University is an equal opportunity/affirmative action employer and encourages women and members of minority groups to compete for this position.

Curriculum vitae, publications, and the names of three or more referees should be sent by 31 December 1981 to: Robert B. Gordon, Chairman, Department of Geology and Geophysics, P.O. Box 6666, New Haven, CT 06511.

Virginia Polytechnic Institute and State University/Senior Research Associate. Interesting and abundant research and publishing opportunities, including new University-owned MOS-10 VIRROSES system, VAX 11/780 computer. Must have experience in theory and application of reflection seismology, and be interested in the application of reflection seismology to the solution of geologic problems.

Send resumes to: Dr. D. R. Wones, Department of Geological Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061-0798

The University is an equal opportunity/affirmative action employer.

Paleologist Northern Illinois University. Applications are invited for a tenure track position in igneous or metamorphic petrology at the assistant or associate professor level beginning either January, 1982 or August, 1982. A Ph.D. degree is required and post-doctoral research experience is preferred. The successful candidate will be expected to pursue an active research program, teach at the undergraduate and graduate level, and direct Masters and Ph.D. graduate research work. Facilities housed within the Department of Geology include a fully automated electron microprobe, SEM, solid-source and gas-source mass spectrometers, AA, XRD, and XRF. To receive full consideration, please send resume, statement of research interests, and the names of three references, by November 1, 1981, to Jonathan H. Berg, Search Committee Chairman, Department of Geology, Northern Illinois University, DeKalb, Illinois, 60115

An equal opportunity/affirmative action employer.

Petroleum Geophysicists/New Zealand Geological Survey. New Zealand is undergoing major expansion of its energy research investigations including prospecting for hydrocarbons The Department of Scientific and Industrial Research, the principle Government R & D Agency, and advisor to government and industry in science and technology, has a vacancy in its Geological Survey for a seismic interpreter The position, in the Petroleum and Basin Studies Section requires a person with a sound geological background primarily for regional analysis for the Basin Studies Programme.

Qualifications: A good 4 year bachelor s degree or higher, and at least 3 years petroleum exploration experience, are preferred

Salary: A salary of up to NZ$23,920 per annum is offered for this position, depending on qualifications and experience.

Further information, application forms etc , may be obtained from the Ambassador Extraordinary and Plenipotentiary, New Zealand Embassy. Washington D.C. Applicants should quote Vacancy No 2557 and forward applications, accompanied by a resume, to

The Ambassador Extraordinary and Plenipotentiary
New Zealand Embassy
Observatory Circle, NW
Washington DC 20008
United States of America

Closing date for applications November 3, 1981.

Geophysicist/Geologist The University of Texas at Austin, Institute for Geophysics. Four research scientist positions are now available at the University of Texas Institute for Geophysics In the fields of marine geophysics, tectonics, seismic stratigraphy, seismic reflection techniques and data processing, ocean bottom seismometer (OBS) and other seismographic instrument design and development, earthquake seismology, and lunar and planetary seismology

The Institute maintains a modern dockside facility at Galveston, Texas (Galveston Marine Geophysics Laboratory), where a new marine building will be built next year. There is also a component of the Institute based in Austin The Institute has a mainframe computer facility for processing and analyzing geophysical data and will be obtaining a new VAX interactive computer system early next year. The Institute maintains two research vessels, the R/V IDA GREEN and the R/V FRED H MOORE, which have capabilities for conducting marine geophysical surveys including the collection of magnetics, multifold seismic reflection data (48-channel), sonobuoy data, and OBS refraction and earthquake data

This two-ship capability offers the exciting opportunity to conduct two-ship seismic experiments. In addition, the Institute operates extensive seismographic networks in several Central American and Caribbean countries The Institute maintains close ties with the staff and facilities of the Department of Geological Sciences, which include modern radiometric, isotope, and paleomagnetic laboratories

A Ph D degree is required, preferably in Geology or Geophysics Salaries are negotiable depending upon experience and qualifications The person must have the ability and desire to work on group projects, conceive and initiate new projects, collect and reduce data, and publish the results. If you are interested in this excellent opportunity to pursue a challenging career in the forefront of geophysical research in an academic setting, please send your qualifications and references to:

Director
The University of Texas
Institute for Geophysics
Galveston Marine Geophysics Laboratory
700 The Strand
Galveston, Texas 77550.

The University of Texas is an equal opportunity/affirmative action employer

Geophysicist: North Carolina State University—Raleigh. The Department of Marine, Earth and Atmospheric Sciences is reopening the search to fill a presently available tenure track position in geophysics. Rank is at the Assistant or Associate professor level A Ph D is required

Primary responsibilities will include generating and conducting research programs as well as teaching graduate courses in geophysics The department currently consists of 31 regular faculty members including 16 in the areas of geology and geophysics Please send resume and names of three references to J L. Langfelder, Head, Department of Marine, Earth and Atmospheric Sciences, North Carolina State University, Raleigh, NC 27650 Deadline for receipt of applications is December 1, 1981.

North Carolina State University is an equal opportunity affirmative action employer

University of Hawaii Faculty Positions. The Department of Geology and Geophysics and the Hawaii Institute of Geophysics have openings for the 1981–1982 academic year. Rank is open dependent on qualifications. We are seeking persons who will participate in our teaching and research programs in any of the following areas: (1) structural geology and marine tectonics, (2) hydrology and engineering geology, (3) marine sedimentology, magnetics, and gravity. To apply send a letter of interest, a current vita and 3 letters of reference to Dr S. O Schlanger, Chairman, Department of Geology and Geophysics, University of Hawaii, 2525 Correa Road, Honolulu, Hawaii 96822 (808 948-7826), or Dr. C. E Helsley, Director, Hawaii Institute of Geophysics, same address (808-948-8760). Open until filled

The University of Hawaii is an affirmative action and equal opportunity employer

California Space Institute, University of California, Santa Barbara: Research position in Remote Sensing. Basic and applied research in some combination of remote sensing of coastal zones, land use-land cover, natural and agricultural vegetation, and soil moisture with skills in information systems, automated image analysis, and quantitative modelling. We seek an independent worker with the goal of deepening and widening existing work in these areas on this campus Ph D. preferred Rank and salary commensurate with experience. Closing date: November 30, 1981. Submit resume; a brief account of research interests; and names of three professional referees to Dr. David S Simonett, Department of Geography, University of California, Santa Barbara, California, 93106.

The University of California, Santa Barbara, is an equal opportunity/Affirmative Action employer.

Senior Faculty Position: Meteorology. Applications and nominations are invited for a senior faculty position in meteorology, at the University of Utah. Eligible applicant will also be considered for chairperson of the department. Candidates must possess a Ph.D in meteorology or a related discipline Applicants should have teaching and research experience and be interested in participating in both the graduate and undergraduate programs. Applicants should submit curriculum vitae and names of three professional references to:

Dr. Jan Paegle
Search Committee
Department of Meteorology
University of Utah
Salt Lake City, Utah 84112

Deadline for applications November 30, 1981.
The University of Utah is an affirmative action/equal opportunity employer.

Faculty Position Environmental Engineering. Beginning January or September 1982. The position requires undergraduate and graduate teaching and sponsored research activities in the areas of water quality control and water resources. An engineering doctorate is required and at least one degree in civil engineering is preferred. Rank will be at the assistant professor level and salary will depend upon qualifications. Apply to: Dr. Lester A. Hoel, Chairman, Department of Civil Engineering, University of Virginia, Charlottesville, Virginia 22901.

An affirmative action/equal opportunity employer.

Research Associate/Electron Microprobe. The Electron Microscopy Center at Texas A&M University invites application for the position of electron microprobe specialist Applicants should possess a working knowledge of WDS and EDS spectrometers and accompanying computer and software programs and preferably have had experience in the geological sciences.

The primary duties of the position are to oversee and maintain (with the aid of service contracts) the electron microprobe and ancillary equipment and to assist in teaching graduate course laboratories dealing specifically with electron microprobe analysis

Salary will be a maximum of $20,000-12 months

Applicant should send supporting data and letter of recommendation to:

Dr. E. L. Thurston
Texas A&M University
Geological Sciences Building
College Station, Texas 77843

Texas A&M is an equal opportunity/affirmative action employer.

Geophysicist. Faculty position for 12-month, tenure track appointment. A sea-going marine seismologist with interests in seismic reflection, refraction or microseismicity is sought. Candidates with strong backgrounds in non-marine seismology or other branches of marine geophysics will also be considered.

Duties include maintaining active research programs and obtaining outside funding, teaching graduate courses and supervising graduate students. Rank is Associate Professor.

Applicants who meet all requirements, but have less experience than is normally required for Associate Professor rank, will be considered for appointment at the rank of Assistant Professor. Salary—$24,000 to $37,000, commensurate with experience.

Send resume and names of three references by 1 October 1981 to G. Ross Heath, Dean, School of Oceanography, Oregon State University, Corvallis, Oregon, 97331

OSU is an affirmative action/equal opportunity employer.

City University of New York, [Brooklyn College]: Faculty Positions. The Department of Geology anticipates filling several tenure track positions at Full Professor level. [Salary range up to $43,400) Highly qualified individuals will be considered for distinguished appointments at an additional $5,000

While candidates who have distinguished themselves in any field are welcome to contact us, we are particularly interested in openings in: energy resources (esp petroleum), exploration geophysics, environmental geology or hydrogeology, coastal sedimentology, economic geology.

Successful applicants will be required to institute an active research program, supervise Master's and Ph.D theses. Nominations and applications with current vitae should be sent to. Dr. S. Bhattacharji, Chairman, Dept of Geology, Brooklyn College of City University of New York, Brooklyn, New York 11210 Positions open until filled.

Brooklyn College, CUNY, is an affirmative action/equal opportunity employer.

Assistant/Associate Professor
Mackay School of Mines
University of Nevada-Reno

The Department of Geological Sciences invites applications for the tenure track academic year position of assistant or associate professor of Geology to teach undergraduate and graduate courses (M.S and Ph.D.). We are seeking an outstanding person with potential for teaching, establishing new laboratories and conducting and supervising research in the Basin and Range and adjoining Provinces. Publishable research will be expected Areas of expertise within geology which will receive favorable consideration are structural geology, sedimentology, stratigraphy and carbonate petrology.

The position will be filled in either January or August 1982, depending on the availability of candidates. The Ph.D. or equivalent degree is required. Salary and rank will depend on education and experience. Candidates should send a letter of application, list of publications, statement of teaching and research interests and transcripts and should arrange for at least three letters of reference to be sent to the Department Closing date for application is November 15, 1981. Applications are to be sent to: Dr. L. C. Hsu, Chairman, Faculty Search Committee, Department of Geological Sciences, Mackay School of Mines, University of Nevada, Reno, NV 89557.

University of Nevada is EOE/AAE.

Postdoctoral Position Hydrologist/Soil Physicist. Research related to subsurface radioactive wastes storage in unsaturated fractured rock; assessment and prediction of water and solute transport. Salary $20,000 to $24,000 depending on qualifications. Position available October 1, 1981. Send resumé, transcript, and reprints of major publications to Dr. Daniel D. Evans, Department of Hydrology and Water Resources, University of Arizona, Tucson, AZ 85721.

Equal opportunity/affirmative action, title IX section 504 employer.

Yale University/Department of Geology and Geophysics. Applications are solicited for a faculty position in solid earth geophysics to begin in the academic year 1982–83. Areas of interest to the Department include seismology, exploration geophysics, mechanical and physical properties of rocks and minerals, geomagnetism, and tectonophysics.

Yale University is an equal opportunity/affirmative action employer and encourages women and members of minority groups to compete for this position.

Curriculum vitae, publications and the names of three or more referees should be sent by 31 December 1981 to Robert G. Gordon, Chairman, Department of Geology and Geophysics, P.O. Box 6666, New Haven, CT 06511.

Research Associate in Geochemistry/University of Chicago. Post-doctoral position involving extraction of micro-samples from meteorites under clean conditions and analysis for major and trace elements by instrumental and radiochemical neutron activation. Goal is to investigate behavior of the elements during condensation of the solar system.

Experience in geological samples an asset, in meteorites a definite plus and in radiochemistry a necessity. Send vita and names of two referees to Professor Lawrence Grossman, Department of Geophysical Sciences and Enrico Fermi Institute, University of Chicago, Chicago, Illinois 60637.

The University of Chicago is an affirmative action/equal opportunity employer.

Research Position in Chemical Oceanography. California Institute of Technology, Division of Geological and Planetary Sciences. The position of research fellow is being offered at Caltech for research in oceanography. Investigation of the isotopic composition of neodymium and rare earth abundances in sea water and sediments is now being carried forward. The mechanism of injection of REE into sea water will be studied. The differences in $^{143}Nd/^{144}Nd$ in various water masses [Piepgras *et al.*, Earth and Planet Sci. Lett. 45, 223–236 and Piepgras and Wasserburg, Earth and Planet. Sci. Lett 50, 128–138 (1980)] is now being carried forward as an exploratory venture in order to determine the origin and chemical behavior of REE in the ocean and the potential use of $^{143}Nd/^{144}Nd$ as a tracer. The laboratory facilities for sample preparation and analysis are fully functional and will be available. Applicants should have training in oceanography and a good perspective on general physical oceanographic models.

Send resume and references to Professor G. J. Wasserburg, Lunatic Asylum, California Institute of Technology, Pasadena, CA 91125.

Caltech is an equal opportunity/affirmative action employer (M/F/H).

Atmospheric Scientist/Group Head. Senior staff scientist position available immediately at the NAIC's Arecibo Observatory. The successful applicant will be appointed as Head of the Atmospheric Sciences Group and will be expected to lead that group and to perform independent research using the Arecibo facilities. A Ph.D. degree in atmospheric or physical sciences or radar engineering and a record of solid research accomplishments are required. Experience with radar studies of the stratosphere, mesosphere, and ionosphere or with the modifications of the ionosphere is desirable. Salary open. Please send resume and names of at least three references to Dr. Harold O. Craft, Jr., Acting Director, NAIC Observatory, Space Sciences Building, Cornell University, Ithaca, New York 14853.

NAIC/Cornell University are EOE/AAE.

SERVICES

URANIUM DEPOSITS. If you are financing, planning, designing, exploring, drilling, or digging in connection with any form of energy, you need this complete, up-to-date book about the world's uranium deposits. Includes production and reserves for mines. Hardcover, 6 × 9 inches, 303 pages. Table of contents, drawings, index, references, 1978. $98. Teach Associates, 120 Thunder Road, Sudbury, Mass. 01776.

COURSES

MSA Amphiboles Short Course. The Mineralogical Society of America will sponsor a Short Course on Amphiboles and Other Hydrous Pyriboles at the Marydale Retreat Center in Erlanger, Kentucky, October 26 to November 1, 1981, before the MSA/GSA Annual Meeting in Cincinnati, Ohio.

Instructional staff will be:

J. G. Thompson, Jr. (Harvard)—Polysomatism and polytypism in pyriboles
F. C. Hawthorne (Manitoba)—Crystal chemistry of amphiboles
S. Ghose [Univ. Washington]—Subsolidus reactions of amphiboles
P. Robinson [Univ. Massachusetts]—Amphiboles of metamorphic rocks
M. C. Gilbert [VPI]—Phase equilibria and amphiboles of igneous rocks
O. R. Veblen (Johns Hopkins) (Convenor and Editor)—Wide-chain pyriboles
T. Zeltal [Univ. Minnesota]—Mineralogy of amphibole asbestos
M. Ross (USGS)—Geological occurrence of amphibole asbestos

Contact: MSA, 2000 Florida Avenue, N.W., Washington, D.C. 20009. Telephone: 202/462-6913.

Registration Deadline: October 1, 1981.

STUDENT OPPORTUNITIES

Graduate Study in Space Physics and Astronomy. Rice University is pleased to offer Fellowships for entering graduate students in the Department of Space Physics and Astronomy. Exciting research is underway in the fields of theoretical and experimental space plasma physics, magnetospheres of the earth and planets, atmospheric and ionospheric physics, laboratory studies of Rydberg atoms, laser research, space solar power studies, and astronomy and astrophysics.

The fellowships for first year students presently are $4545 tax/free for a months, plus tuition, and involve only 4–5 hours tutoring, grading, or instructing per week for four semesters. Research assistanceships for summers and subsequent years are generally available at $550 per month. Students with exceptional undergraduate records and GRE scores are eligible for an additional $1000 Presidential Recognition Award. Raises are expected for next year.

Address inquiries to: Dr. Patricia Reiff, Assistant Chairman, Department of Space Physics and Astronomy, Rice University, 77001.

Meetings

First Announcement for AGU Chapman Conference on Discontinuities in Rock

An AGU Chapman Conference, 'Discontinuities in Rock, Their Role and Significance in Geologic Processes,' will be convened by Lawrence Teufel and Robert Rieckar at Bishop's Lodge near Santa Fe, N. M., May 3–6, 1982.

Technical Description

Tectonic deformation of rock in a supracrustal environment (low pressure and temperature) characteristically produces visible discontinuities. Discontinuities strongly affect the elastic properties, mechanical strength, and hydraulic properties of the rock mass. Mechanical and hydraulic properties of discontinuous rock have become subject to detailed research only recently. Accumulating data indicate that discontinuities are both the dominant flow paths as well as the weakest links in rock mass stability. Moreover, laboratory and field data now demonstrate clearly interaction between mechanical and hydraulic behavior. These studies prove that stress-flow behavior of a single discontinuity is nonlinear. In addition, recent laboratory research on jointed rocks indicates specimen size scale effects.

The mechanisms of formation, and the mechanical and hydraulic behavior of individual geologic discontinuities, have been addressed both empirically and theoretically. However, constitutive representation for rock that contains numerous discontinuities, and incorporates the interaction and the interdependence of discontinuities, has not been well established. How can we formulate and predict the in-situ bulk deformational response and the coupled hydraulic properties of rock containing discontinuities? We need better understanding of the factors that influence the in-situ behavior of discontinuous rock; it is of fundamental importance to the earth sciences. Improved understanding will have significant impact on exploitation of hydrocarbon and mineral resources, the construction of engineering works, development of geothermal energy, and isolation of radioactive waste.

This conference will consider geologic discontinuities as a multidisciplinary problem involving geologists, geophysicists, engineers, hydrologists, experimentalists, and theoreticians. The conference will bring together individuals of diverse research expertise, but with a common interest in the mechanical and hydraulic response of discontinuous rock, in order to integrate current knowledge and to initiate new research ideas and collaborations. Proposed topics of the conference include (1) mechanics of formation, and characteristics of geologic discontinuities; (2) mechanics and constitutive laws of a single discontinuity and a discontinuous rock mass; (3) deformational processes and geophysical phenomena of discontinuous rock; (4) fluid flow through a single discontinuity and hydraulic properties of a discontinuous rock mass.

Conference Committee

Lawrence Teufel, Sandia National Laboratories, Albuquerque, N.M.; Robert Rieckor, Los Alamos National Laboratory, Los Alamos, N.M.; James Dieterich, National Center for Earthquake Research, U.S. Geological Survey, Menlo Park, Calif.; Paul Gnirk, RE/SPEC, Inc., Rapid City, S.D.; John Logan, Center for Tectonophysics, Texas A&M University, College Station, Texas; David Pollard, National Center for Earthquake Research, U.S. Geological Survey, Menlo Park, Calif.; Carl Sondergeld, Amoco Production Research Center, Tulsa, Okla.; Paul Witharspoon, Lawrence Berkeley Laboratory, University of California, Berkeley, Calif.

Student Travel

Limited funding, upon application, is available to support student travel expenses to the conference. Deadline for application is December 15, 1981.

Participation

Those interested in attending should write to Lawrence Teufel, Geomechanics Division 5532, Sandia National Laboratories, Albuquerque, NM 87185, or Robert Rieckar, Los Alamos National Laboratory, Geosciences Division Office MS 570, Box 1663, Los Alamos, NM 87545, and should state their interest in the meeting. To ensure the maximum interchange of ideas on this subject, attendance will be limited. Participants will be selected from those applying.

Deadline for application is December 15, 1981.

Energy in the Mountain States: Resources and Problems

A Symposium on Energy in the Mountain States, sponsored by the Front Range Branch of AGU and the Geology Department of the University of Colorado, will be held on Tuesday afternoon, September 22, 1981, at the University of Colorado (Boulder campus) in the Forum Room of the University Memorial Center. Starting at 1:00 P.M., brief presentations will be given on the following topics:

Petroleum and Gas: Philip H. Stark, Petroleum Information, Inc. *Coal:* Keith Murray, Energetics, Inc. *Oil Shale:* Willard Chapell, University of Colorado, Denver. *Solar:* Keith Haggard, Solar Energy Research Institute. *Geothermal:* L. Trowbridge Grose, Colorado School of Mines. *Summary:* John Rold, Chief Geologist, Colorado State Geological Survey

A panel discussion on 'Science, Technology, and Energy Public Planning' follows at 3:30 P.M. The panel will consist of the above speakers as well as Jane Quinby, Grand Junction City Planning Commission, and Steve Schmitz, Colorado State Department of Local Affairs.

Conference on Scientific Ocean Drilling (COSOD)
Sponsored by JOIDES

ORGANIZATION AND COORDINATION OF PLANS FOR FUTURE SCIENTIFIC OCEAN DRILLING PROGRAMS

November 16–18, 1981, Austin, Texas
Convened by COSOD Steering Committee,
R. L. Larson, Chairman

Sessions Planned:

November 16, 17

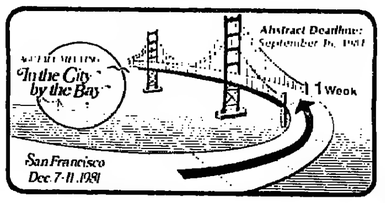
Reports and workshop discussions on the relation of the following topics to ocean drilling:

1. Origin and Evolution of Oceanic Crust
2. Origin and Evolution of Marine Sedimentary Sequences
3. Tectonic Evolution of Continental Margins and Oceanic Crust
4. Causes of Long-Term Changes in the Atmosphere, Oceans, Cryosphere, Biosphere, and Magnetic Field
5. Tools, Techniques, and Associated Studies

November 18

General Discussion on Coordination of Existing and Planned Scientific Ocean Drilling Programs

The meeting will be open to the general scientific community, and there is no registration fee The conference will begin at 9:00 AM on November 16 at the Joe C Thompson Conference Center, Room 3.102, on the University of Texas campus. For hotel reservations and other travel arrangements, please contact Mercury Travel, 1333 New Hampshire Ave , N.W., Washington D.C. 20036, phone (202) 296-7862



GAP

Separates

To Order: The order number can be found at the end of each abstract; use all digits when ordering.

Cost: $3.50 for the first article and $1.00 for each additional article in the same order. Payment must accompany order.

Deposit Account: A minimum of $10.00 may be placed on deposit with AGU for the purchase of separates. It funds are on deposit, the cost of the first article is only $2.00 and $1.00 for each additional article in the same order.

Separates will be mailed within 3 weeks of journal publication or within 10 days if ordered after the journal has appeared. Separates are available for purchase for two years from date of publication.

Copies of English translations of articles from Russian translation journals are available either in unedited form at the time of their listing in EOS or in final printed form when a journal is published. The charge is $2.00 per Russian page.

Send your order to:
American Geophysical Union
2000 Florida Avenue, N.W.
Washington, D.C. 20009

Aeronomy

0418 Absorption and Scattering of Radiation (Including ozone)

A METHOD FOR CALCULATING THEORETICAL PHOTOELECTRON FLUXES RESULTING FROM THE He^{+} 304 Å SPECTRAL LINE
R. G. Richards (Center for Atmospheric and Space Sciences, Utah State University, UMC 34, Logan, Utah 84321)

A. F. Nagy (same address)

We present a method for evaluating the ionospheric photoelectron fluxes resulting from the 304 Å solar radiation. This method can be used to verify the full theoretical calculation of photoelectron fluxes. The formula may also be useful in monitoring variations in the 304 Å solar flux whenever direct solar flux measurements are unavailable. We have also performed photoelectron flux calculations using two different sets of inelastic electron collision cross sections. Fluxes obtained using an old set of cross sections are in good agreement with measured fluxes from Atmosphere Explorer-E but are up to a factor of two larger at energies between 30 and 50 eV than fluxes from most other previously published theoretical calculations, however, spectra obtained with a newer larger set of collision cross sections are in agreement with the other theoretical models, but not with the measured spectra. This suggests that the disagreement between ionospheric photoelectron theory and experiment might be resolved by a revision of the electron collision cross sections used in the theoretical models. (photoelectron, cross sections)

Geophys. Res. Lett., Paper 1L1306

0410 Absorption and scattering of radiation

SPECTROSCOPIC IDENTIFICATION OF $ClCF_2$ IN THE LOWER STRATOSPHERE

A. Goldman (Department of Physics, University of Denver, Denver, Colorado 80208), F.J. Murcray, A.H. Bonomo, R.D. Blatherwick, R.N. Stocker and D.G. Murcray

Infrared atmospheric spectra were obtained at ~0.02 cm^{-1} resolution during a balloon flight made on 5/23/81. These spectra show no absorption features near 928 cm^{-1} which we identify as due to $ClCF_2$ (Freon-22). A preliminary estimate from the nearest spectra shows approximately 100 ppty F-22 near 15 km.

Geophys. Res. Lett., Paper 1L1302

0410 Composition

COMMENTS ON "A METEOR-ABLATION MODEL OF THE CONSTANT Ca "IN METEOR-ABLATION MODEL OF THE SODIUM AND POTASSIUM LAYERS" BY G.B. HUNTER, S. Clemesha (TSPE, C.P. 515, S.J. dos Campos, S.P. Brazil), V.W.J.H. Kirchhoff and B.R. Clemesha)

The published results of lidar observations of the atmospheric sodium layer show that any constant change in the abundance of sodium consistent change in the abundance of sodium over the night is very small, and that there is probably little change between day and night. These measurements also show that the nightly increase in sodium observed at mid-latitudes occurs mainly on the bottomside of the layer. Recent, 24-hour observations show that any diurnal component in the diurnal variation in 24-hour component in the diurnal variation in abundance is less than about 30 of the annual abundance is less than about 30 of the annual mean at least as it stands the recently proposed meteor-ablation model, in which sodium atoms ablate into the atmosphere during meteor ablation are lost by ionization and subsequent attachment of the ions to aerosols; it shown to be inconsistent with these experimental data. (Sodium model, meteor ablation).

Geophys. Res. Lett., Paper 1L1132

Particles and Fields—Magnetosphere

5290 Instruments and techniques

A COMPARISON OF EQUATORIAL ELECTRON DENSITIES MEASURED BY WHISTLERS AND BY A SATELLITE RADIO TECHNIQUE

D. L. Carpenter (Radioscience Laboratory, Stanford University, Stanford, Calif.), R. R. Anderson (University of Iowa, Department of Physics and Astronomy, Iowa City, Iowa), T. F. Bell and T. R. Miller (Radioscience Laboratory, Stanford University, Stanford, Calif.)

For the first time, data on magnetospheric equatorial electron density from multiple whistler paths have been compared with in situ satellite measurements of electron density along near-equatorial orbits. The whistler data were recorded at Siple, Antarctica (L ~4.2) on June 30 and July 19, 1978, and at Palmer, Antarctica (L ~2.5) on April 10, 1978. The satellite data were obtained by the University of Iowa Plasma Wave Experiment sweep frequency receiver (SFR) to 118-1 during passes that remained within ~15° of the observing whistler station's longitude. The compared data are mostly in the range L = 3.2 and represent the signature magnetosphere under calm to moderately disturbed magnetic conditions. The results support the assumption that the electron density distribution about the high altitude part of field lines in the outer plasmasphere can be described by a diffusive-equilibrium model. The data further suggest that the densities within the observed whistler ducts were within less than 30° of the mean or intended level, and that over the L ranges of the comparisons, there were no significant near-west density gradients within about ~15° of the whistler station's longitude.

Geophys. Res. lett., Paper 1L1134

Izvestiya Physics of the Solid Earth

Volume 16, Number 5

CONTENTS